

**T 2133 EN****Type 9 Temperature Regulator · DIN version**Self-operated Temperature Regulators · With balanced three-way valve <sup>1)</sup> · Flanged connections**Application**

Temperature regulators with mixing or diverting valve designed for plants that are heated or cooled using liquids · Control thermostats for set points from **-10 to +250 °C** · Three-way valves **DN 15 to 150** · Pressure rating **PN 16 to 40** · Suitable for temperatures **up to 350 °C**

**Note**

Temperature regulators (TR), safety temperature monitors (STM) and safety temperature limiters (STL) tested according to DIN EN 14597 are available.

The regulators consist of a three-way valve and a control thermostat with temperature sensor, set point adjuster with excess temperature protection, capillary tube and operating element.

**Special features**

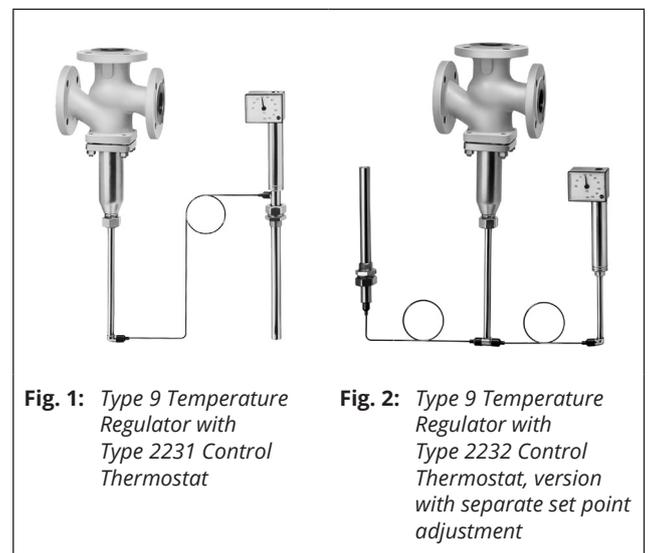
- Low-maintenance proportional regulators requiring no auxiliary energy
- Wide set point range and convenient set point adjustment
- Three-way valve with plug balanced <sup>1)</sup> by a stainless steel bellows, optionally available with a plug arrangement to mix or divert liquids
- Flow rate across the port AB independent of the valve plug position
- Valve body optionally available in cast iron, cast steel or cast stainless steel
- Versions with double adapter and manual adjuster for temperature limiters or attachment of a second control thermostat. See Data Sheet ▶ T 2036 for details.

**Versions****Type 9 Temperature Regulator with three-way**

**valve** · Type 2119 Valve · DN 15 to 25 (unbalanced) · DN 32 to 150 (balanced) · PN 16 to 40 · Type 2231 to 2234 Control Thermostat

Three-way valves with optional plug arrangements for either mixing or diverting service. Further details on the application of thermostats can be found in Information Sheet ▶ T 2010.

**Type 2119/2231** (Fig. 1) · With Type 2119 Valve and Type 2231 Control Thermostat · Suitable for liquids and steam · Set points from -10 to +150 °C · Set point adjustment at the sensor



**Fig. 1:** Type 9 Temperature Regulator with Type 2231 Control Thermostat

**Fig. 2:** Type 9 Temperature Regulator with Type 2232 Control Thermostat, version with separate set point adjustment

**Type 2119/2232** (Fig. 2) · With Type 2119 Valve and Type 2232 Control Thermostat · Suitable for liquids and steam · Set points from -10 to +250 °C · Separate set point adjustment · With clamping gland for larger immersion depths

**Type 2119/2234** · With Type 2119 Valve and Type 2234 Control Thermostat · Suitable for liquids, air and other gases · Set points from -10 to +250 °C · Separate set point adjustment

**Special version**

- 10 or 15 m capillary tube lengths
- Sensor of CrNiMo steel
- Capillary tube, copper with plastic coating
- Valve entirely of stainless steel (at least 1.4301)
- ANSI version on request (▶ T 2134)

<sup>1)</sup> DN 15 to 25 unbalanced

## Principle of operation (see Fig. 3 and Fig. 4)

The regulators operate according to the liquid expansion principle. The temperature sensor (11), capillary tube (8) and operating element (7) are filled with an expansion liquid. The temperature-dependent change in volume of this liquid causes the operating element to move and, as a result, also moves the plug stem (5) with the attached plug (3). The position of the plug determines the flow rate of the heat transfer medium across the area released between the seat (2) and plug (3). The temperature set point is adjustable with a key (9) to a value which can be read off from the dial (10).

In the balanced valves (DN 32 to 150), the pressure at port B acts through a hole in the plug stem (5) onto the outer surface of the balancing bellows 1) (4.1), whereas the pressure at port A acts onto the inner bellows area. This equalizes the forces acting onto the valve plugs (3). In mixing valves (see Fig. 3 with plug arrangement I), the process media to be mixed enter at valve ports A and B. The combined flow exits the valve at port AB. The flow rate from A or B to AB is determined by the area released between the seats (2) and plugs (3), i.e. by the position of the plug stem (5). When the temperature rises, port A opens and port B closes.

In diverting valves, in contrast, the process medium enters at the valve port AB and the partial flows exit at ports A or B. The flow rate from AB to A or B is determined by the position of the plug stem. Diverting valves have the plug arrangement II (see Fig. 4). When the temperature rises, port A closes and port B opens.

## Installation

### - Valve

The thermostat connection (6) must face downwards. Other mounting positions on request. Make sure the direction of flow complies with the required service type, i.e. mixing or diverting service.

### - Capillary tube

The capillary tube must be run in such a way that the ambient temperature range cannot be exceeded, any deviations in temperature cannot occur and that the tube cannot be damaged. The smallest permissible bending radius is 50 mm.

### - Temperature sensor

The temperature sensor can be installed in any position as required. Its entire length must be immersed in the medium. It must be installed in a location where overheating or considerable idling times cannot occur. Only the combination of the same kind of materials is permitted, e.g. a stainless steel heat exchanger with thermowells made of stainless steel 1.4571.

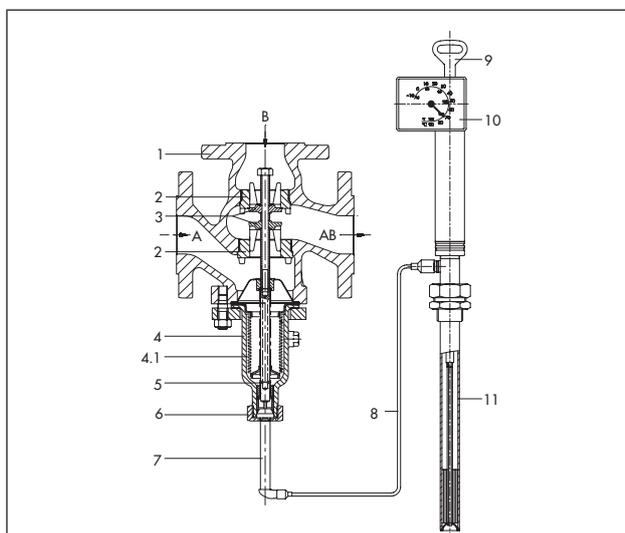
### - Thermowell

#### Type 2231

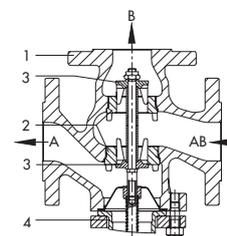
The sensor of the control thermostat can be used with or without a thermowell. The standard thermowell length is 290 mm.

#### Type 2232

The sensor of the control thermostat can be used with or without a thermowell. The standard thermowell length is 235 mm.



**Fig. 3:** Type 9 Temperature Regulator with three-way valve (DN 50) and Type 2231 Control Thermostat, three-way valve with plug arrangement I (the arrows indicate mixing service)



**Fig. 4:** Type 9 Temperature Regulator with three-way valve, with plug arrangement II (the arrows indicate diverting service)

#### Three-way valve

- 1 Valve body
- 2 Seat (exchangeable)
- 3 Plug
- 4 Bottom section (bellows housing)
- 4.1 Balancing bellows
- 5 Plug stem with spring

- 6 Thermostat connection (threaded nipple with coupling nut)

#### Control thermostat

- 7 Operating element
- 8 Capillary tube
- 9 Set point adjustment key
- 10 Set point dial
- 11 Temperature sensor (bulb sensor)

The version with clamping gland can be used for larger immersion depths (max. 990 mm possible with SAMSON thermowells). It is also possible to use non-SAMSON thermowells provided on site with different immersion depths. In this case, the immersion depth of the sensor can be varied as required depending on the length of the capillary tube.

For reasons of safety and because the function to seal the sensor is missing, the use of the clamping gland is only permitted with a thermowell.

#### Type 2234

The sensor of the control thermostat can only be used without a thermowell. The maximum sensor length is 460 mm.

<sup>1)</sup> Valves in DN 15 to 25 have unbalanced plugs

**Table 1:** Technical data · All pressures in bar (gauge). The listed permissible pressures and differential pressures are restricted by the specifications in the pressure-temperature diagram and the pressure rating.

Type 2119 Three-way Valve													
Pressure rating		PN 16 to 40											
K <sub>VS</sub> coefficients and max. permissible differential pressures Δp in bar													
Connection		DN	15	20	25	32	40	50	65	80	100	125	150
Mixing valve	K <sub>VS</sub> coefficient		4	6.3	8	16	20	32	50	80	125	160	200
	When p in B > p in A	Δp	10			16			10			8	
	When p in A > p in B	Δp	5			3.5			3			2	
Diverting valve (when AB to A or B)	K <sub>VS</sub> coefficient		4	6.3	8	16	20	32	40	64	100	125	160
	Δp		4			3.5			3			2	
Permissible temperature of the valve		220 °C/350 °C · See pressure-temperature diagram in ▶ T 2010											
Leakage class according to IEC 60534-4		Metal seal: leakage rate l (≤0.05 % of K <sub>VS</sub> )											
Conformity		<b>CE</b>											
Type 2231 to 2234 Thermostat													
		<b>Size 150</b>											
Set point range (set point span 100 K)		-10 to +90 °C, 20 to 120 °C or 50 to 150 °C For Types 2232, 2234 also 100 to 200 °C, 150 to 250 °C											
Perm. ambient temperature at the set point adjustment		-40 to +80 °C											
Perm. temperature at the sensor		100 K above the adjusted set point											
Perm. pressure at sensor		Type 2231 <sup>1)</sup> · Type 2232 <sup>1)2)</sup> Type 2234											
		Without/with thermowell: PN 40 · Thermowell with flange: PN 40 Without thermowell: PN 40 · With flange on request											
Capillary tube length		5 m (10 or 15 m as special version)											

<sup>1)</sup> Other pressure ratings for thermowell/flange on request

<sup>2)</sup> The version with clamping gland can be used for larger immersion depths (max. 990 mm possible with SAMSON thermowells). It is also possible to use non-SAMSON thermowells provided on site with different immersion depths. In this case, the immersion depth of the sensor can be varied inside the thermowell as required.

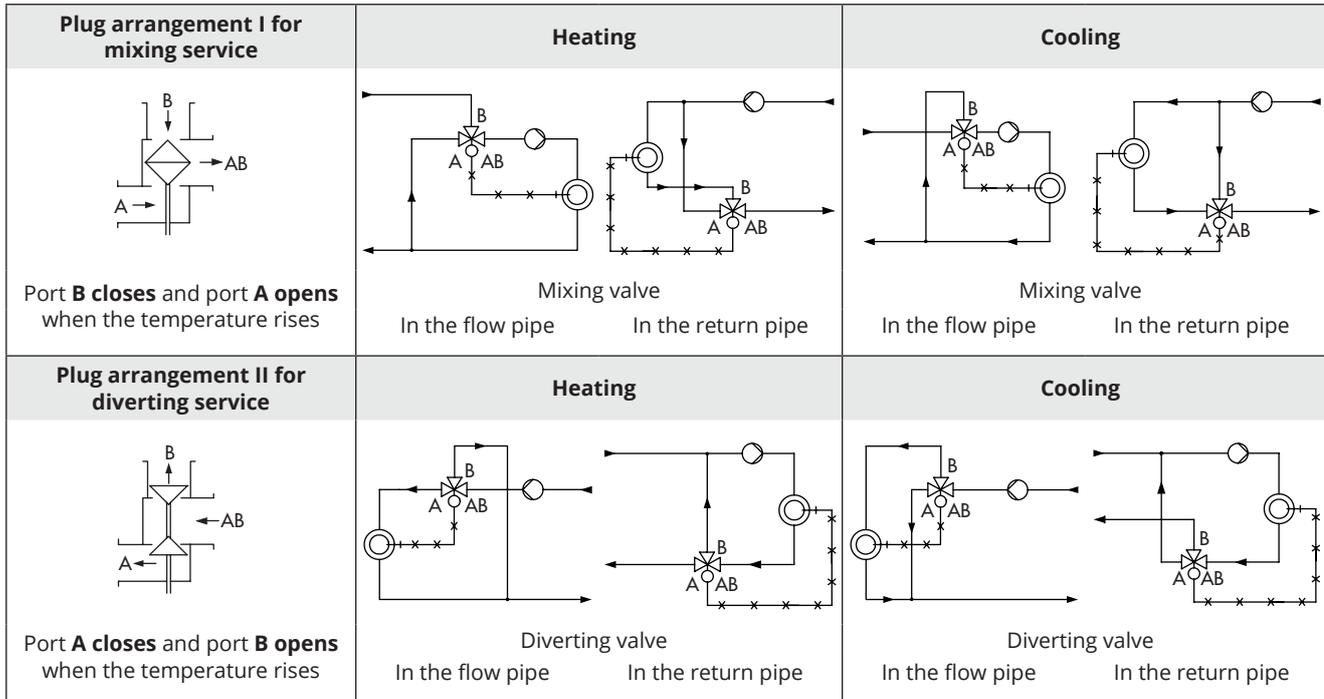
**Table 2:** Materials · Material numbers according to DIN EN

Type 2119 Three-way Valve									
Nominal size		DN 15 to 100		DN 15 to 150					
Pressure rating		PN 25		PN 16		PN 40			
Body		Cast steel 1.0619							
		-		Cast iron EN-JL1040		Cast stainless steel 1.4408			
Seat and plug		Steel 1.4006 (1.4301 for DN 125 and 150)				1.4571			
Plug stem/spring		1.4301/1.4310							
Balancing bellows <sup>1)</sup>		1.4571							
Bellows housing		1.0425				1.4571			
Seal		Graphite on metal core							
Extension piece/separating piece		Brass (special version: stainless steel 1.4301)				1.4301			
Types 2231, 2232 and 2234 Thermostats									
Version		Standard version			Special version				
Operating element		Nickel-plated brass							
Sensor		Type 2231		Bronze		-			
		Type 2232		Bronze		CrNiMoTi steel			
		Type 2234		Copper					
Capillary tube		Copper		Plastic-coated copper					
Thermowell									
G 1 threaded connection		Immersion tube		Bronze, steel, copper <sup>2)</sup>				CrNiMoTi steel	
		Threaded nipple		Brass · Steel					
Flange connection		Immersion tube		Steel				CrNiMoTi steel	
		Threaded nipple		Steel					

<sup>1)</sup> DN 15 to 25; without balancing bellows

<sup>2)</sup> PN 16 only

**Arrangement of temperature regulators with three-way valves** (depending on the plug arrangement in valve) · Schematics

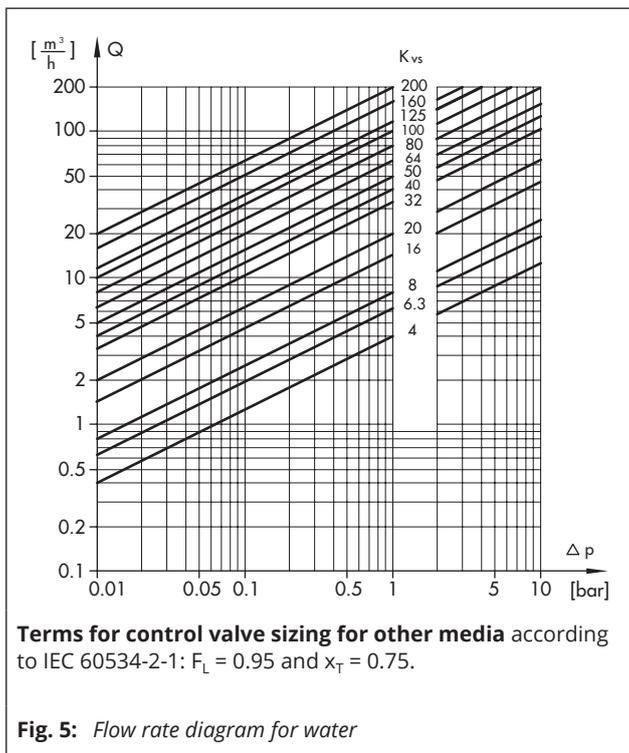


**Typetested safety devices**

The register number is available on request.

**Flow rate diagram for water**

The specifications apply to a fully open valve



**The following versions are available:**

**Temperature regulators (TR)** with a Type 2231, 2232 or 2234 Thermostat and a Type 2119 Three-way Valve in nominal sizes DN 15 to 150, for which the maximum operating pressure must not exceed the maximum permissible differential pressure  $\Delta p$  specified in the technical data.

Sensors without thermowell: applicable up to 40 bar

Sensors with thermowell: only use SAMSON G 1 version made of bronze, steel or stainless steel up to 40 bar, copper up to 16 bar.

Thermowell for flammable gases **typetested by DVGW**, G 1 threaded connection, PN 100.

Further details on the selection application of typetested equipment can be found in Information Sheet **► T 2040**.

Additionally, the following are available:

**Safety temperature monitors (STM)** and **safety temperature limiters (STL)**. Details in Data Sheets **► T 2043** and **► T 2046**.

## Dimensions · Type 2119 Three-way Valve with thermostat

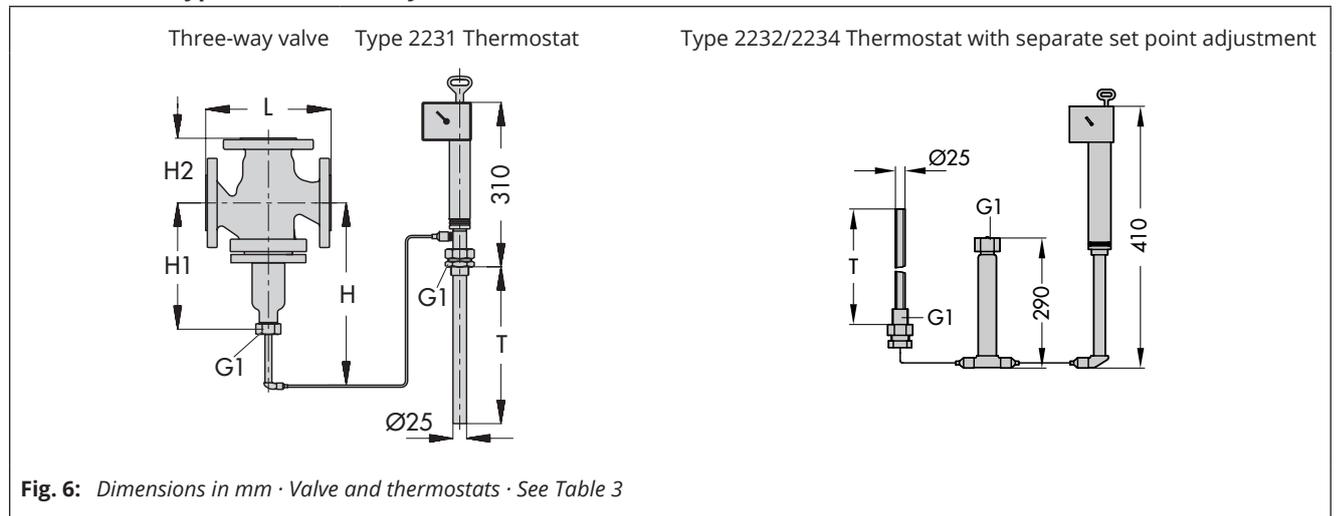


Fig. 6: Dimensions in mm · Valve and thermostats · See Table 3

Table 3: Dimensions in mm and weights

Type 2119 Three-way Valve		DN	15	20	25	32	40	50	65	80	100	125	150
Overall length L			130	150	160	180	200	230	290	310	350	400	480
H2			70	80	85	100	105	120	130	140	150	200	210
H1	Up to 220 °C (without extension piece)		235			240			310		355	390	490
	Up to 350 °C (with extension piece)		375			380			450		495	530	630
H	Up to 220 °C (without extension piece)		525			530			600		645	680	780
	Up to 350 °C (with extension piece)		665			670			760		785	820	920
Weight (PN 16 body) <sup>1)</sup> , approx.		kg	6	7	8.5	15	17	21	31	34	50	76	105
Thermostat		Type	2231			2232			2234				
Immersion depth T			290			235 <sup>2)</sup>			460				
Weight, approx.		kg	3.2			4.0			3.7				

<sup>1)</sup> +15 % for PN 25/40

<sup>2)</sup> Larger immersion depths on request

### Dynamic behavior of the thermostats

The dynamics of the regulator are mainly determined by the response of the temperature sensor with its characteristic time constant.

Table 4 lists the response times of SAMSON sensors operating according to different principles measured in water.

Table 4: Dynamic behavior of SAMSON thermostats

Principle of operation	Control thermostat Type	Time constant [s]	
		Without Thermowell	With Thermowell
Liquid expansion	2231	70 s	120 s
	2232	65 s	110 s
	2234	15 s	- <sup>1)</sup>
	2213	70 s	120 s
Adsorption	2212	- <sup>1)</sup>	40 s

<sup>1)</sup> Not permissible

### Accessories

**Thermowells** with threaded or flanged connections for Types 2231 and 2232 Bulb Sensors · G 1 threaded connection, made of bronze, steel or CrNiMo steel (PN 40) or made of copper (PN 16) · Flanged connection, DN 32, PN 40, with thermowell made of CrNiMo steel/ steel · Thermowell made of PTFE, PN 6 (flange PN 40).

Thermowell for flammable gases **typetested by DVGW**, G 1 threaded connection, PN 100.

**Mounting parts** for Type 2234 · Clamps for wall mounting · Perforated cover for thermostat

To protect the operating element from inadmissible operating conditions, an **extension piece** or **separating piece** must be installed between the valve and the operating element.

An **extension piece** is needed for temperatures over 220 °C. The standard version does not have sealing. The special version of the extension piece for DN 15 to 100 is made of stainless steel and has a bellows seal. It additionally acts as a separating piece.

In combinations with valves made of cast iron or spheroidal graphite iron together with Type 2212 Safety Temperature Limiter or Type 2213 Safety Temperature

Monitor, an extension piece is required for temperatures over 150 °C.

**Separating piece** made of brass (for water and steam) or CrNi steel (for water and oil). A separating piece must be used when a seal between thermostat and valve is required. Separating pieces made of CrNi steel must be used when all wetted parts are to be free of non-ferrous metals. In addition, it prevents the medium from leaking while the thermostat is being replaced.

**Do2 double adapter** for second thermostat · DoS with electric signal transmitter

**Manual adjuster Ma** with travel indicator · **MaS** with electric signal transmitter

**Reversing device** for DN 65 to 100 (item no. 1180-8098). Installed between thermostat connection and operating element with capillary tube. This allows the operating direction to be reversed when the regulator is installed incorrectly in the pipeline.

## Ordering text

### Type 9/... Temperature Regulator

DN ..., PN ...,

Mixing or diverting valve,

Body material ...

With Type ... Thermostat, set point range ... °C

Capillary tube ... m,

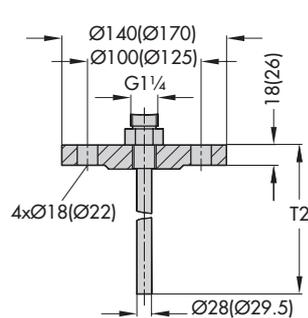
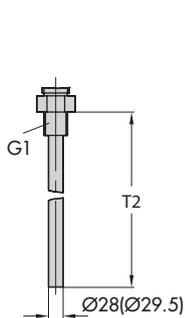
Optionally, special version ...

Optionally, accessories ...

## Dimensions of accessories

### Thermowells for Type 2231/2232

Thermostat	Type 2231	Type 2232
T2	325 mm	250 mm



### With threaded connection

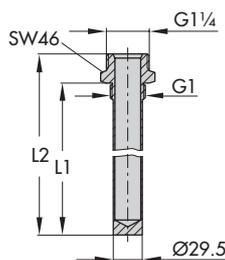
G 1 for PN 40, PN 100  
(dimensions for PN 100 in parentheses), thermowell made of copper: PN 16

### With flanges

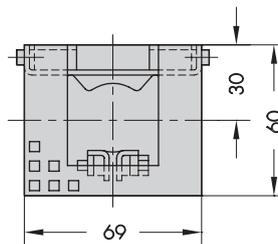
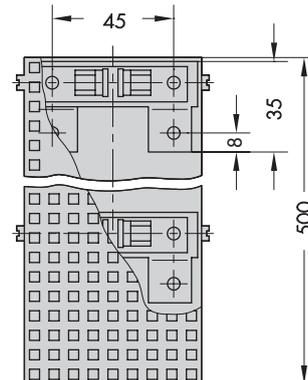
DN 32 for PN 40  
DN 40 for PN 100  
(dimensions in parentheses)

### Thermowell for flammable gases (G 1/PN 100)

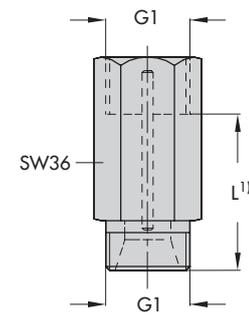
Thermostat	Type 2231	Type 2232
Length L1	315 mm	255 mm
Length L2	340 mm	280 mm



### Clamps and perforated cover for wall mounting (Type 2234) <sup>1)</sup>



### Extension piece/ separating piece



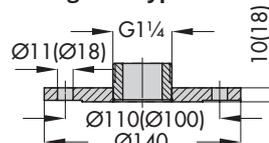
### Extension piece

Standard version  
L = approx. 140 mm, approx. 0.5 kg  
With bellows seal (special version),  
L = approx. 180 mm, approx. 0.6 kg

**Separating piece** with seals,  
L = approx. 55 mm, approx. 0.2 kg

<sup>1)</sup> Add the dimension L to H and H1 when these accessories are used.

### Flange for Type 2234



Flanged connection PN 6; 140 outside Ø  
Flange PN 40/DN 32 (dimensions in parentheses)

<sup>1)</sup> Mounting position of sensor: pointing down Max. torque of clamp on the sensor: 2.5 Nm

Fig. 7: Accessories · Dimensions in mm